

WHAT IS CLAIMED IS:

- 1        1. An infrared imaging apparatus, comprising:
  - 2            a dewar, having an internal volume that defines a cold space;
  - 3            an IR transmissive window that seals the cold space to receive IR
  - 4            energy directly from an IR source;
  - 5            a first lens located within the cold space to receive IR energy directly
  - 6            from the IR transmissive window;
  - 7            an IR detector located within the cold space in operational
  - 8            communication with the first lens and positioned coincident to the focal plane of at
  - 9            least a first and second wavelength of IR energy; and
  - 10            an optical stop located within the cold space in front of the single
  - 11            lens.
- 1        2. The infrared imaging apparatus of claim 1, wherein the single lens  
2        has a first aspheric profile on a first side and a second aspheric profile on a second  
3        side, the first side parallel to the second side and the second side facing the  
4        detector.
- 1        3. The infrared imaging apparatus of claim 2, wherein the second  
2        aspheric profile has a holographic optical element.
- 1        4. The infrared imaging apparatus of claim 3, wherein the holographic  
2        optical element color corrects at least one color band of infrared energy.
- 1        5. The infrared imaging apparatus of claim 4, wherein the holographic  
2        optical element color corrects a red MWIR band and a blue MWIR band.

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1       6. The infrared imaging apparatus of claim 1, wherein the detector is a  
2 hyperspectral detector.

1       7. The infrared imaging apparatus of claim 1, wherein the detector  
2 detects at least three wavelengths of IR energy including at least one LWIR band  
3 of energy.

1       8. The infrared imaging apparatus of claim 1, wherein the LWIR band  
2 of energy is preferably an indigo LWIR band.

1       9. The infrared imaging apparatus of claim 1, wherein the holographic  
2 optical element coincidentally focuses a MWIR band and a LWIR band of IR energy  
3 at a common focal plane.

1       10. The infrared imaging apparatus of claim 1, wherein the second  
2 wavelength of IR energy is a harmonic component of the first wavelength.

1       11. The infrared imaging apparatus of claim 1, wherein the single lens is  
2 made of germanium.

1       12  
1       13. The infrared imaging apparatus of claim 1, wherein the single lens is  
2 made of silicon.

1       14. The infrared imaging apparatus of claim 1, wherein the apparatus  
2 performs at an F-stop (F/#) of at least 1.4 with a square field of view of 90x90  
3 degrees.

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1        15. The infrared imaging apparatus of claim 1, wherein the detector  
2 concurrently collects radiation from multiple, adjacent spectral radiation bands.

1        16. The infrared imaging apparatus of claim 3, wherein the first aspheric  
2 surface has the following prescription:

3           radius = -0.94467;  
4           k = 28.345216;  
5           a = -2.13952;  
6           b = -69.5274;  
7           c = 2342.04;  
8           d = -56841.9; and  
9           first surface thickness = 0.548467.

1        17. The infrared imaging apparatus of claim 16, wherein the second  
2 aspheric surface has the following prescription:

3           radius = -0.61281;  
4           k = 0.1399;  
5           a = 0.033459;  
6           b = -2.3598;  
7           c = 10.889;  
8           d = -36.331; and  
9           second surface thickness = 0.462731.

1        18. The infrared imaging apparatus of claim 17, wherein the holographic  
2 optical element has the following prescription:  
3           -0.0051393, -0.10212, 0.91035, -2.3946.

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1           19. The infrared imaging apparatus of claim 3, wherein the first aspheric  
2 surface has the following prescription:  
3           radius = -1.23508;  
4           k = 36.049455;  
5           a = -1.69104;  
6           b = -98.6413;  
7           c = 5589.83;  
8           d = -162359; and  
9           first surface thickness = 0.761661.

1           20. The infrared imaging apparatus of claim 19, wherein the second  
2 aspheric surface has the following prescription:  
3           radius = -0.81270;  
4           k = -0.10748;  
5           a = 0.054475;  
6           b = -0.72423;  
7           c = 2.9155;  
8           d = -7.8939; and  
9           second surface thickness = 0.480234.

1           21. The infrared imaging apparatus of claim 20, wherein the holographic  
2 optical element has the following prescription:  
3           -0.017112, -0.038991, 0.55069, -1.6405.